Gravity Field Recovery from satellite-to-satellite tracking missions

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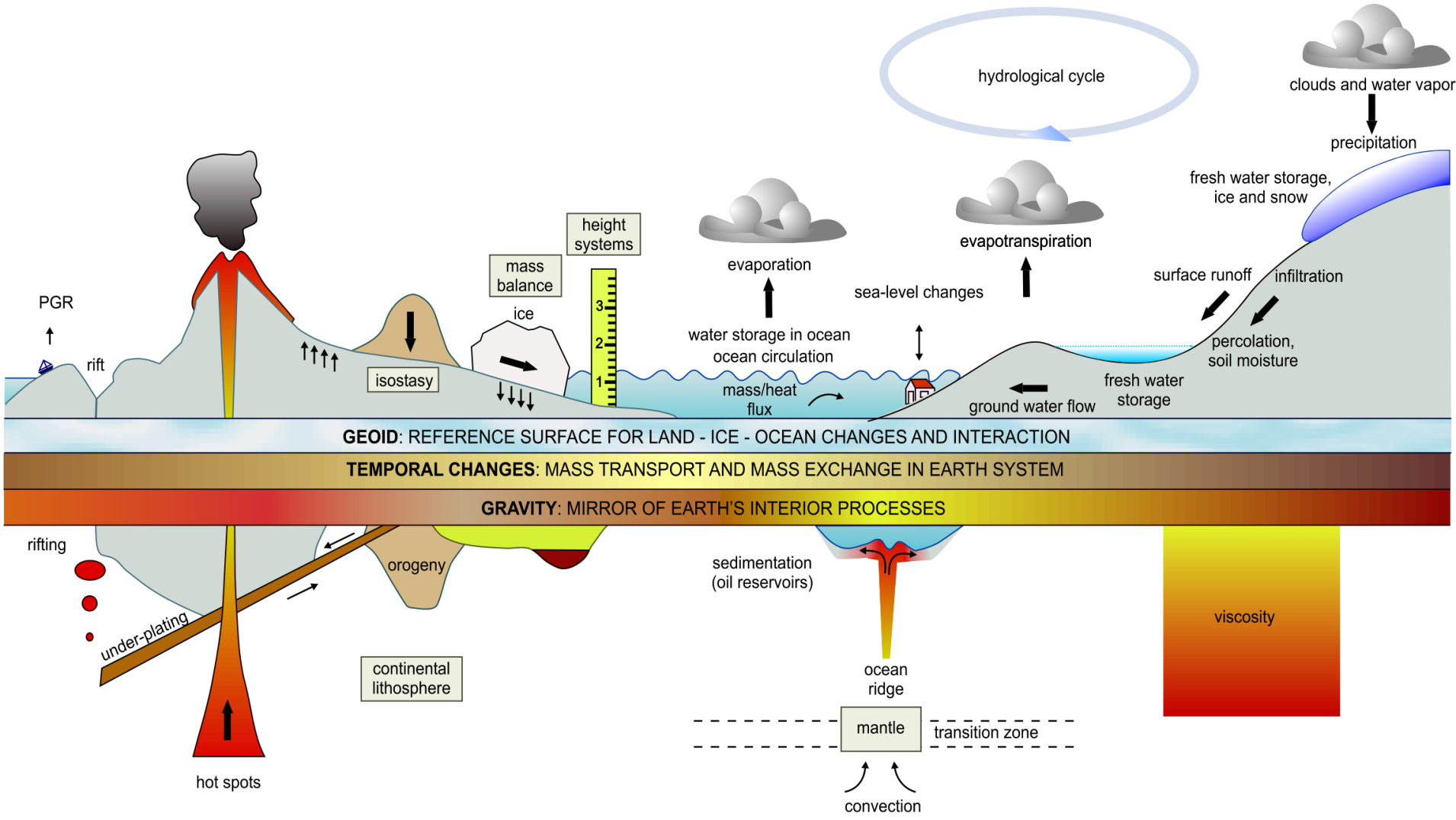
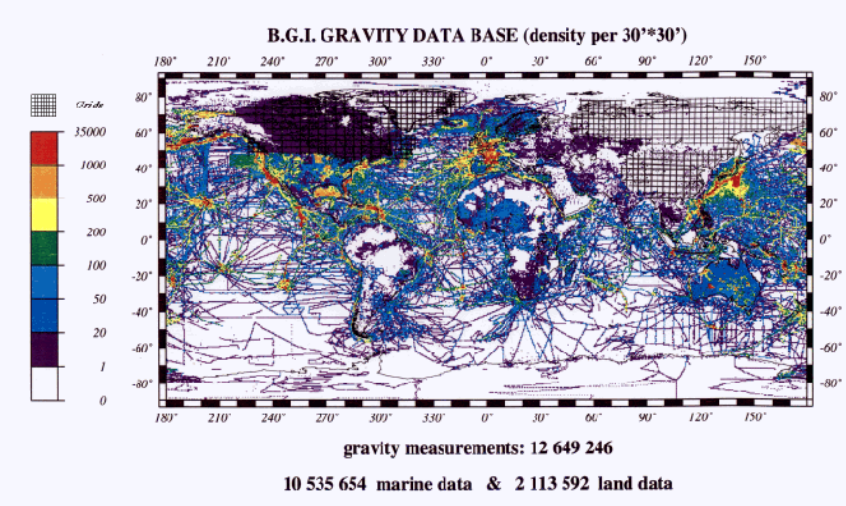
Applications



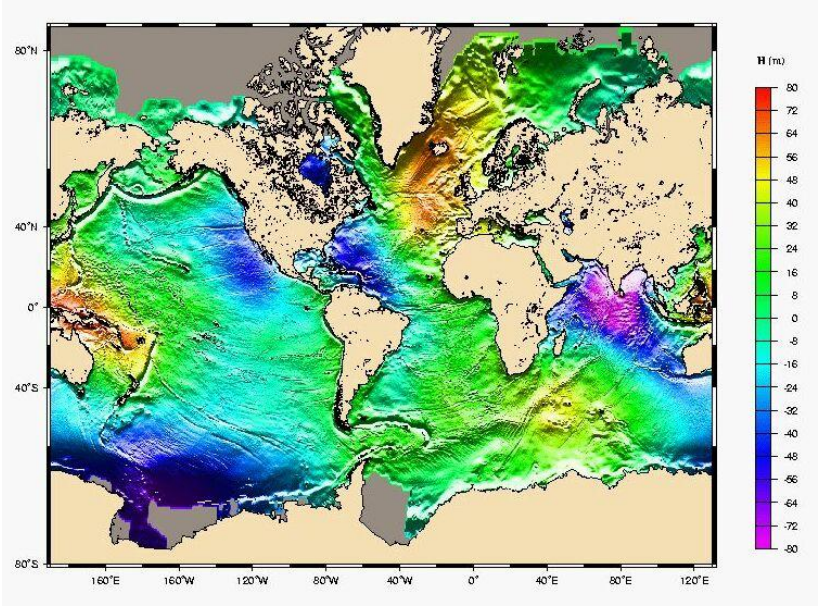
Gravity from Space: why?



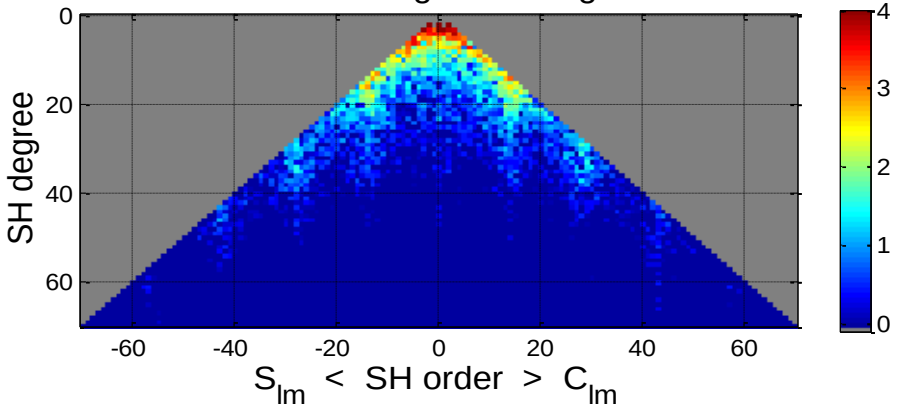
terrestrial gravimetry: inhomogeneous

satellite altimetry:

ocean topography:

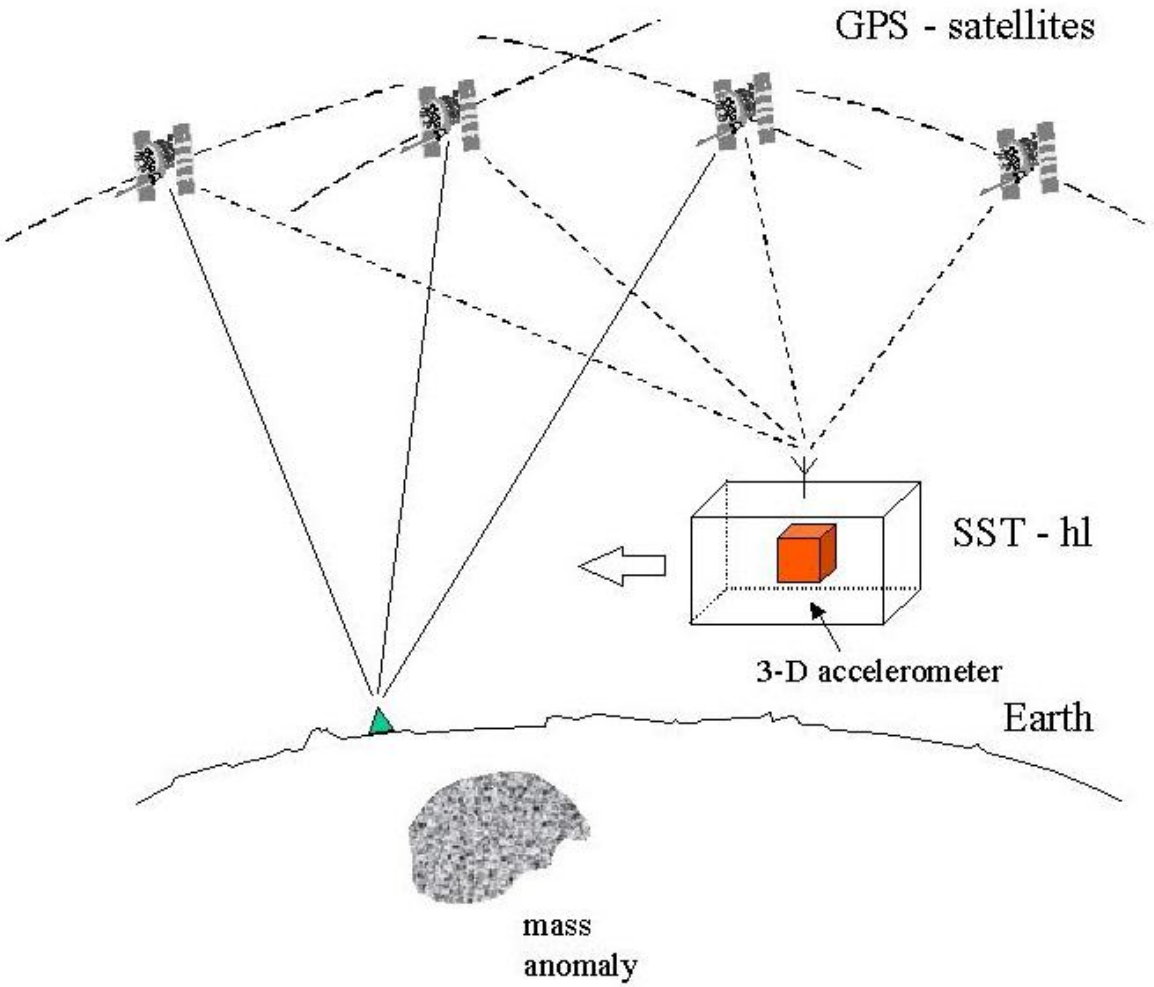


EGM96s significant digits



5 decades of satellite observations

principle: hi-lo SST



Satellite system: CHAMP

CHAMP = CHAllenging Minisatellite Payload

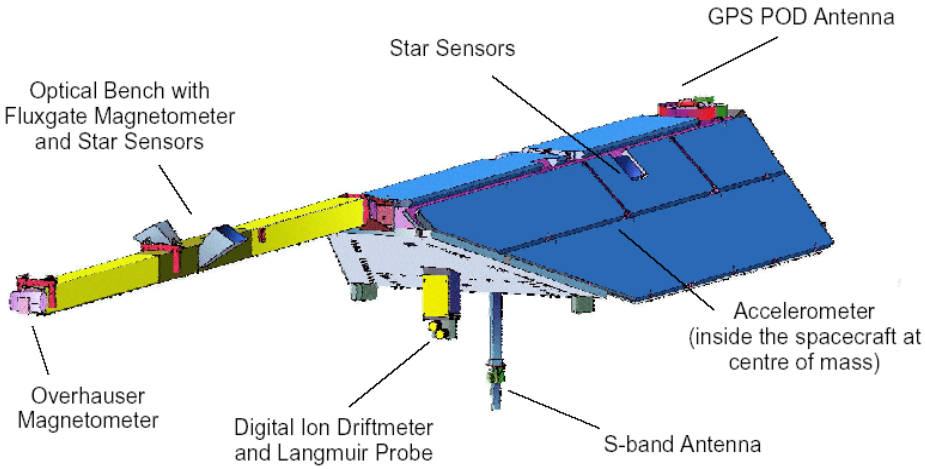
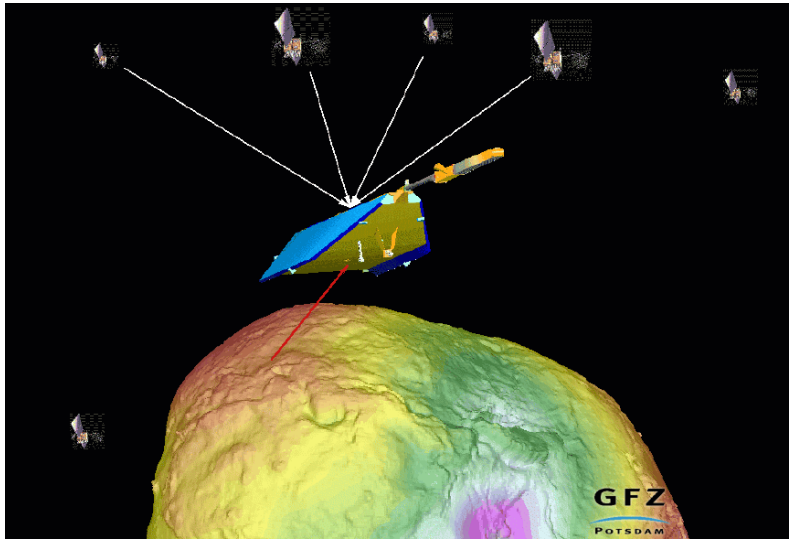


Figure 4-1: Front side view of CHAMP with location of instruments

source: GFZ-Potsdam

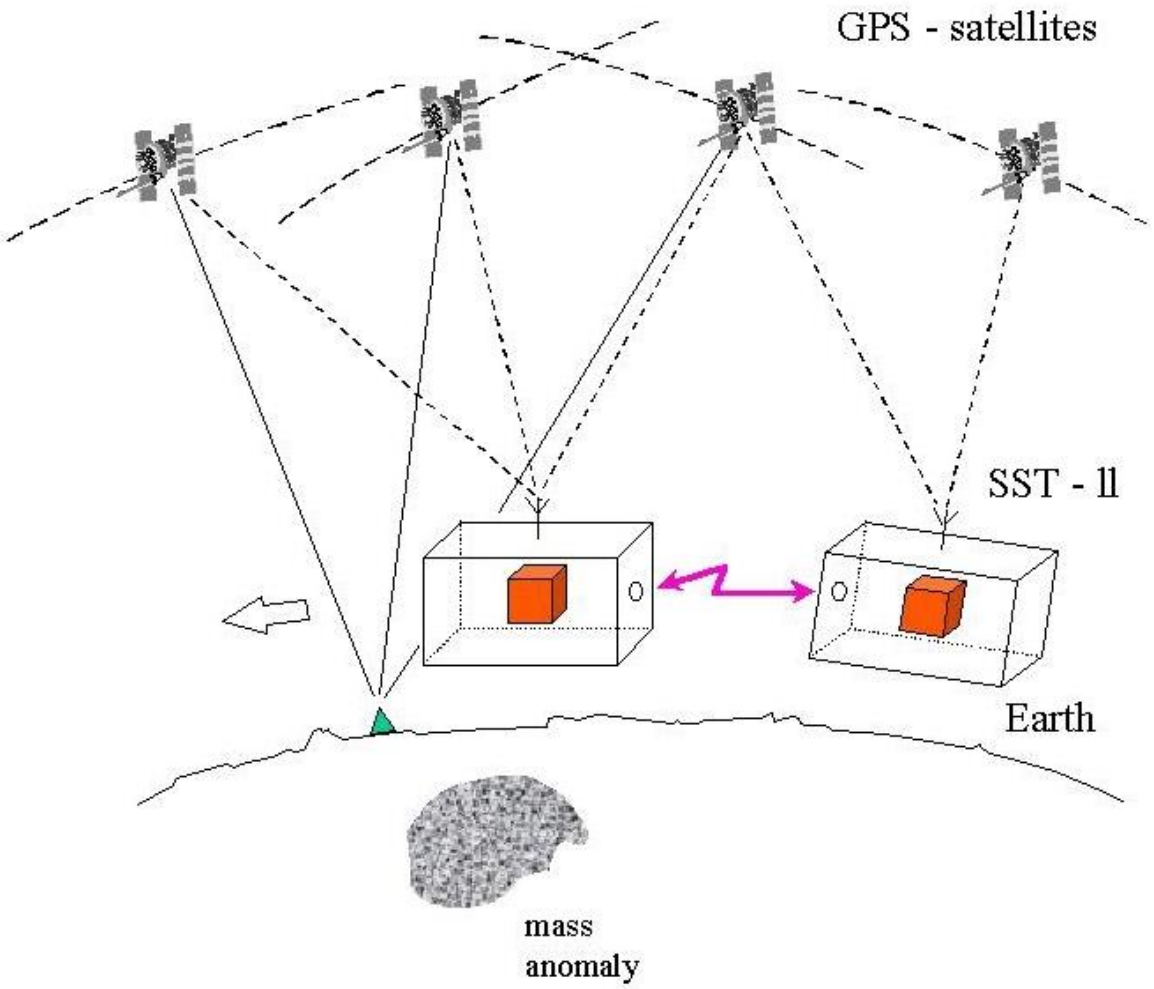
- orbit height: ~ 400 km
- inclination: ~ 87°
- Key instruments:
  - GPS receiver
  - Accelerometer

- principle of high-low SST measurement
- mission duration: 7+ years



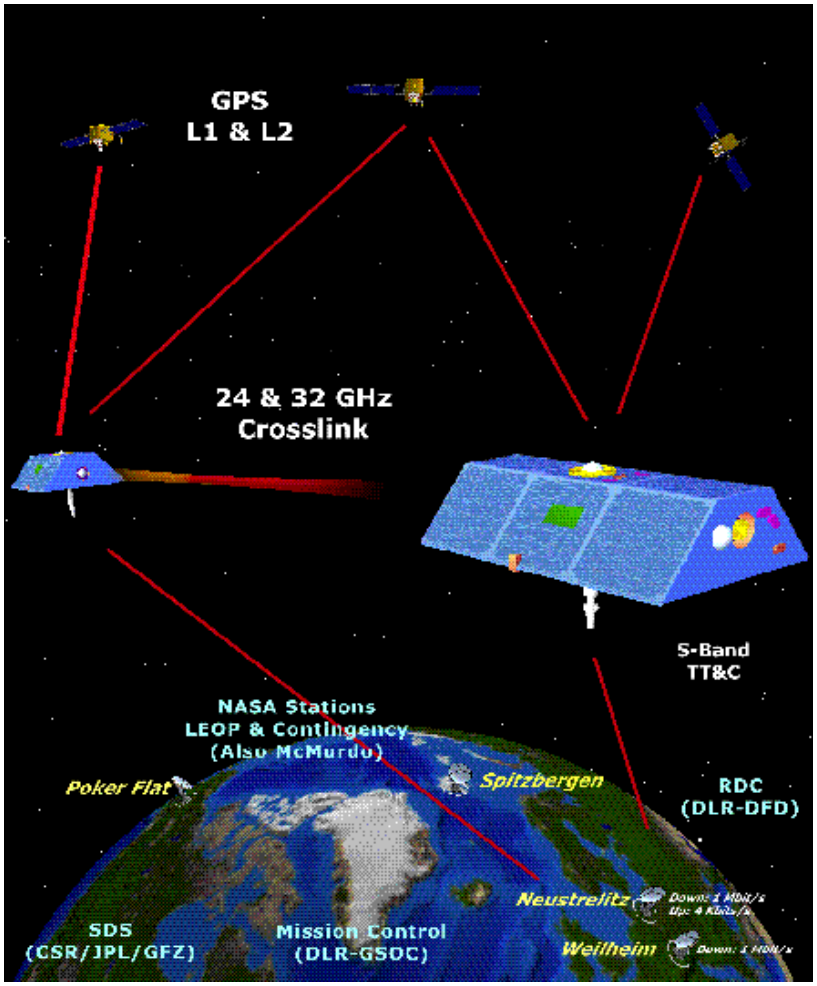
source: GFZ-Potsdam

principle: lo-lo SST



Satellite system: GRACE

GRACE = Gravity Recovery and Climate Experiment

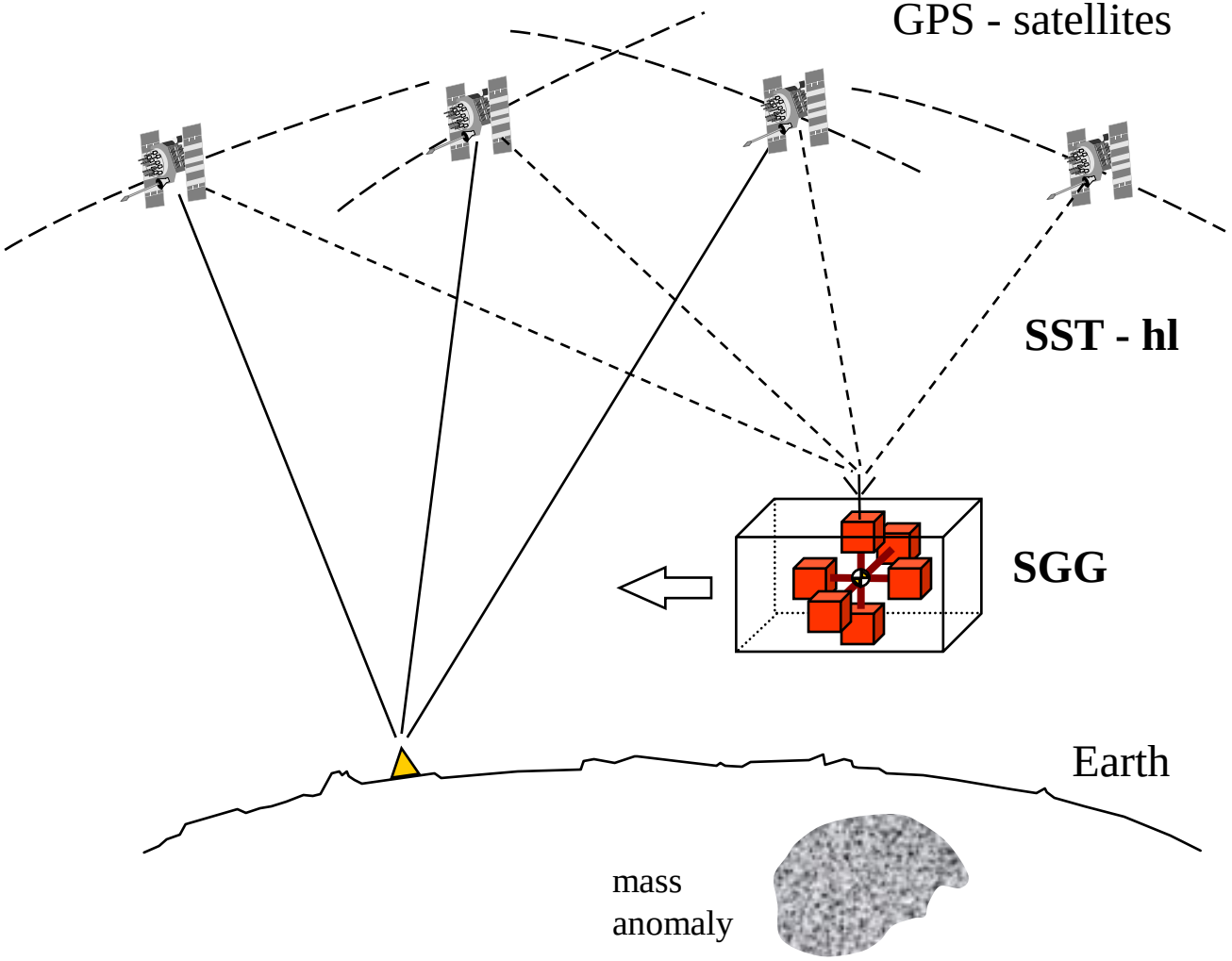


source: GFZ-Potsdam

- Initial orbit height: ~ 485 km
- Inclination: ~ 89°
- Key technologies:
  - GPS receiver
  - Accelerometer
  - K-Band Ranging System
- mission duration: 5+ years
- 14 monthly solutions of the gravity field available

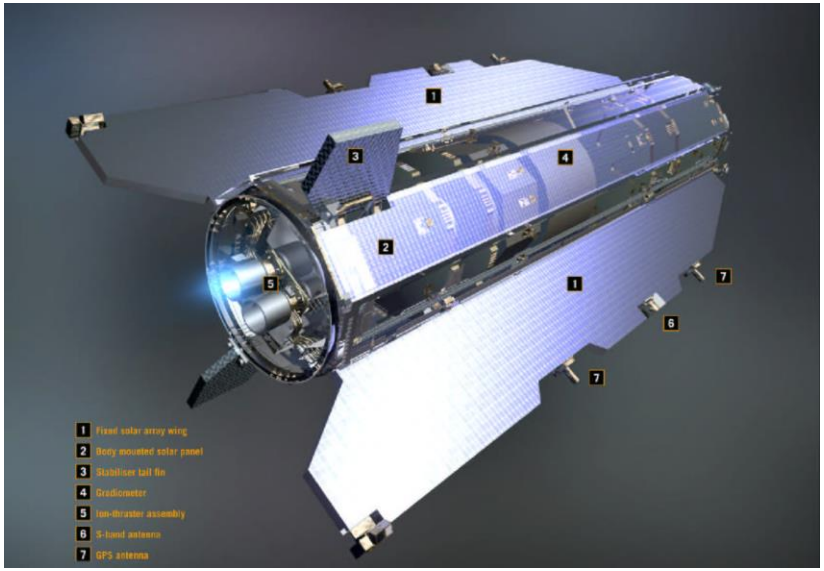
  → time variable gravity field

principle: SGG



Satellite system: GOCE

GOCE = Gravity Field and steady-state Ocean Circulation Explorer



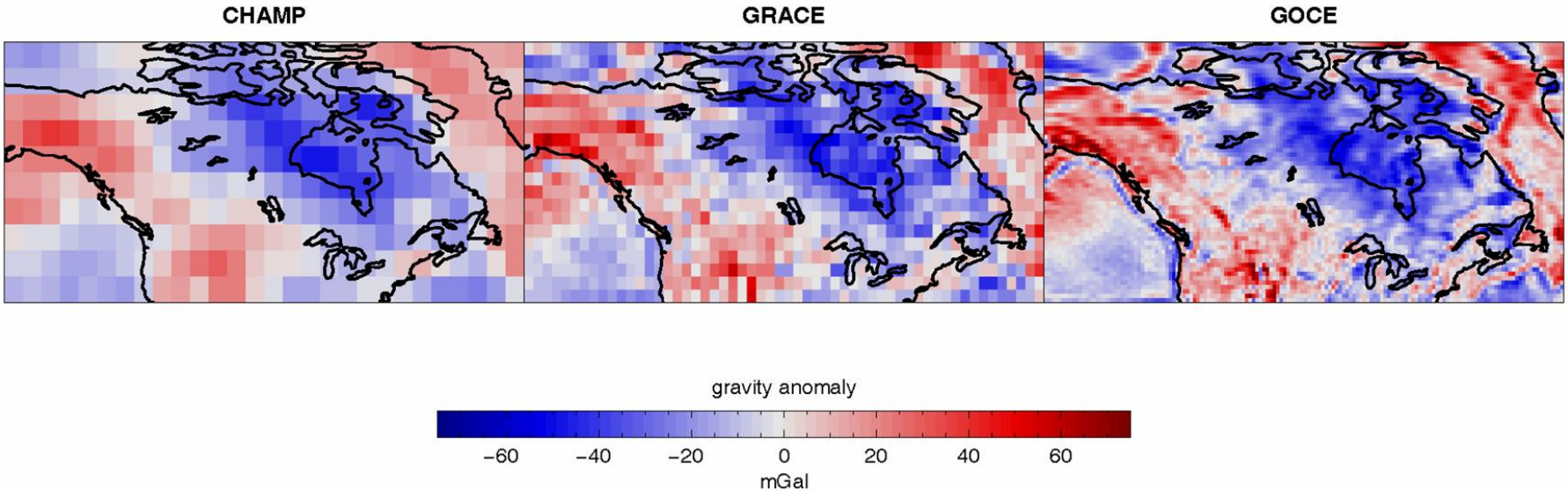
- planned: 2007
- Initial orbit height: ~ 270 km
- Inclination: ~ 96.5°

- Key technologies:
  - GPS
  - Gradiometer
  - Ion thruster system

source: GOCE-Projektbuero

Resolution

- spatial resolution



$L = 50$

$\lambda / 2 = 400$ km

$\Delta T = 1$ month

$L = 100$

$\lambda / 2 = 200$ km

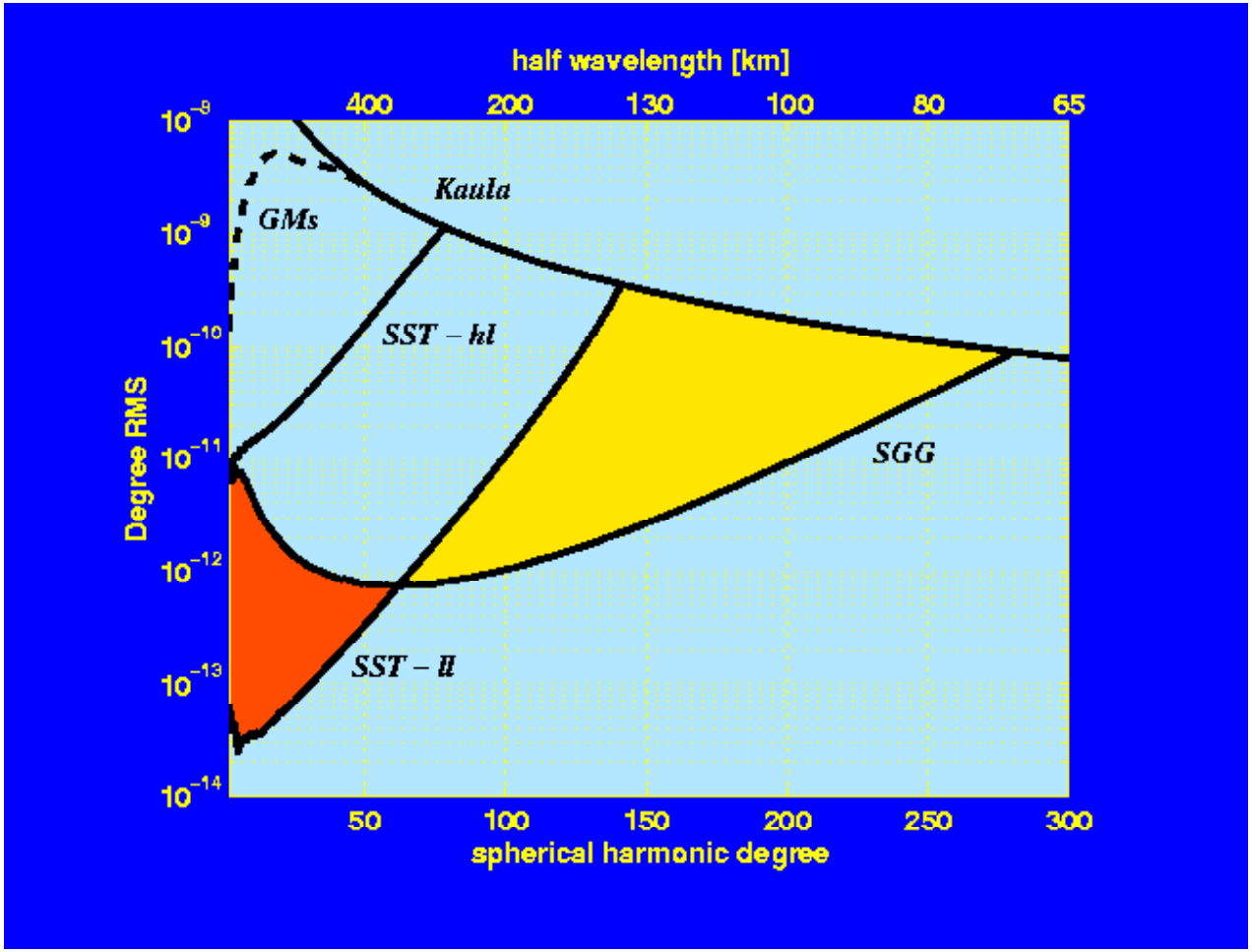
$\Delta T = 1$ month

$L = 300$

$\lambda / 2 = 70$ km

$\Delta T =$ N/A

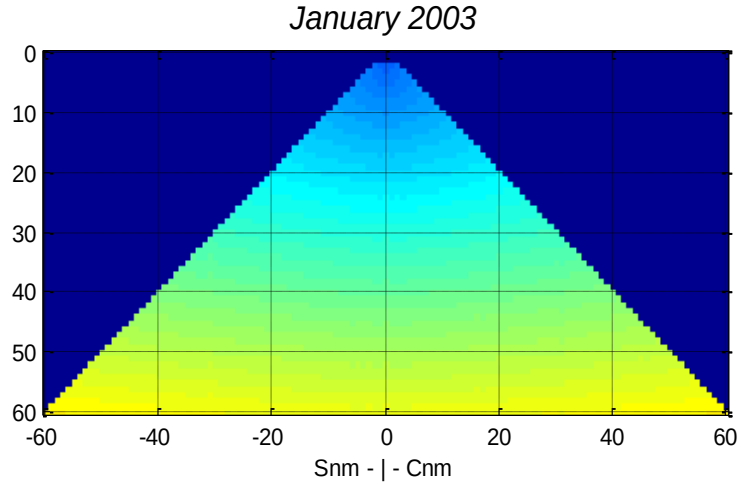
Accuracy

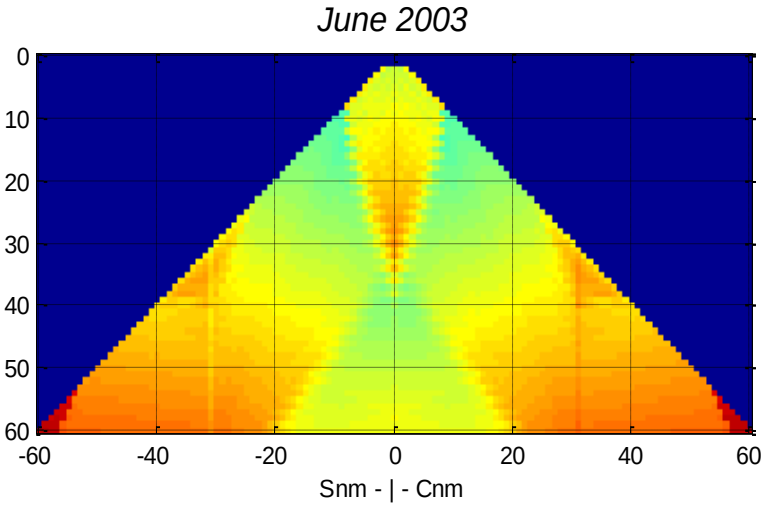


source: GOCE-Projektbuero

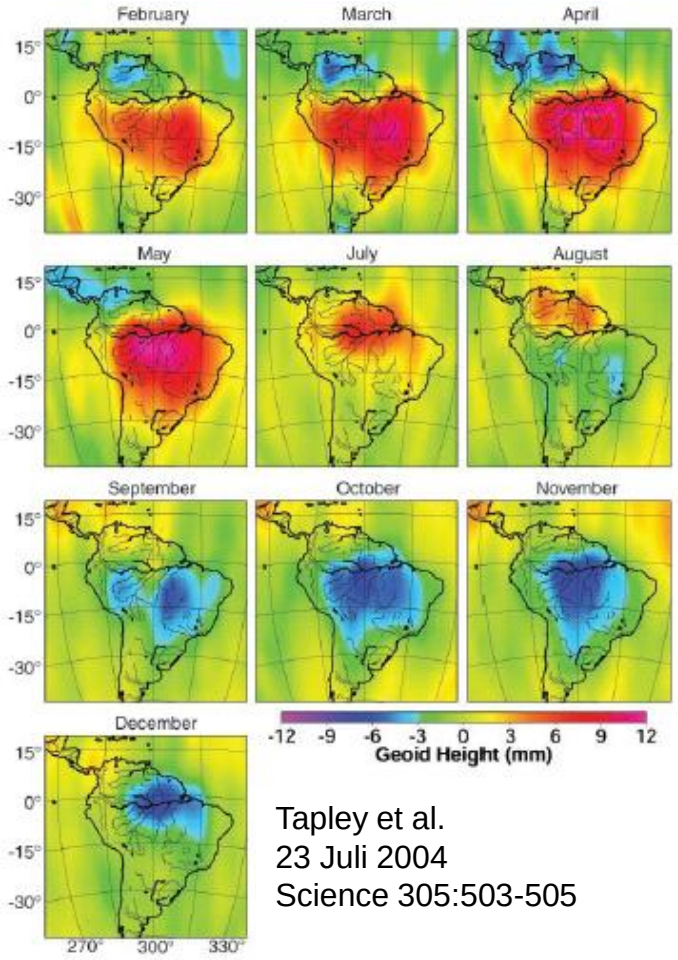
Open issues

- Aliasing:





- Time-variable gravity:



Tapley et al.
23 Juli 2004
Science 305:503-505

- Monitoring → formation flying

Questions?

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